UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF MICHIGAN
SOUTHERN DIVISION

3D SYSTEMS, INC.,)	
)	
Plaintiff,)	
)	Case No. 2:05-cv-74891
v.)	
)	Hon. Avern Cohn
ENVISIONTEC, INC., ENVISIONTEC GMBH,)	Magistrate Judge R. Steven Whalen
and SIBCO, INC.,)	
)	
Defendants.)	
)	

DECLARATION OF DR. PAUL F. JACOBS IN SUPPORT OF
DEFENDANTS' MOTION FOR SUMMARY JUDGMENT
OF NON-INFRINGEMENT

I, Dr. Paul F. Jacobs, submit this Declaration in support of Defendants' Motion for Summary Judgment of Non-Infringement. The facts set forth below are based on my personal knowledge, and if called to testify, I could and would testify competently thereto.

1.   I was the Director of Research & Development for 3D Systems, Inc. from 1989 until 1997. During that time, I directed research with respect to the fundamentals of the stereolithography process and also helped developed numerous important commercial applications. I am also the author of the first book in the field: "Rapid Prototyping & Manufacturing: Fundamentals of Stereolithography" which was published by SME in 1992. Subsequently I authored another volume: "Stereolithography and Other RP&M Technologies" that was published jointly by SME and McGraw-Hill in 1996. I have written over 130 publications and have been a teacher at UCLA, Princeton University, Clemson University, and Worcester Polytechnic Institute. I am a named inventor on 21 United States patents.

2.   Based upon my study and analysis it is my opinion that the Perfactory and Vanquish machines of Envisiontec do not infringe any claim of the '981, '537, '143, and '934 patents.

A.   The Perfactory and Vanquish Machines and Methods of Operation

3.   It is my understanding that Mr. Siblani, Dr. Schillen, and Mr. Shkolnik designed and developed the Perfactory and Vanquish machines and their method of operation. I have reviewed the machines, reviewed technical information relating to the machines and their operation, and conducted discussions for obtaining other relevant information prior to formulating my opinions and conclusions on infringement.

4.   The Perfactory and Vanquish machines create a solid model of an object based on a computer aided design ("CAD") model. They employ a photopolymer (or curable resin) which

1

is a viscous liquid material that solidifies when light is applied to it. The photopolymer contains chains of smaller molecules called "monomers" which polymerize to form long chains and/or form bonds between chains ("cross-linking") in response to light. The solidification of the resin is generally referred to as "curing".

5.   Both the Perfactory and Vanquish machines use a digital light projector ("DLP") to apply light to a curable resin. The DLP is a projector that contains a large array of mirrors, each of which is movable. It is my understanding that the movement of the mirrors dictates the intensity of light projected from them. Further, it is also my understanding that each mirror projects a unique light intensity to a location on the surface of the curable resin. The light intensity and the length of time that it is applied determine the depth to which the resin is cured. Thus, it is my understanding that the DLP provides a unique curing depth for each location on the surface of the resin corresponding to a respective mirror from the array of mirrors in the DLP projector. I expect to describe the operation of the DLP projector by referring to technical information that I have reviewed including the technical information provided by Envisiontec in this case.

6.   It is my understanding that both the Perfactory and Vanquish machines convert the CAD model into individual "voxels" or "volumetric pixels" that dictate the movement of the mirrors in the DLP device. That is, each individual voxel corresponds to a specific mirror in the DLP. Further, each mirror is capable of projecting light intensities ranging from 0-255, with 0 being the minimum intensity and 255 being the maximum intensity. It is my understanding that each voxel uniquely corresponds to one of the mirrors in the DLP and dictates the intensity of the light projected from that mirror to the resin. Through this process of voxelization, it is my

2

understanding that the Perfactory and Vanquish machines use a projection system which projects millions of squared light spots in a matrix onto the resin.

7.   It is also my understanding that the voxel matrix results from providing a three-dimensional build envelope or volume and subdividing the build volume into volume elements which are called voxels. The intersection between each voxel and the three-dimensional part to be manufactured is determined and the intersection amount, if any, is converted into a brightness intensity value that is unique for each voxel and independent of any other voxel. The brightness intensity values (gray scale values) are used to generate a bitmap stack for the entire build volume of the part to be manufactured before any exposure takes place.

8.   I understand that Dr. Schillen prepared at least one animation illustrating the voxelization process used by Envisiontec in its Perfactory and Vanquish machines. I have relied upon the animation prepared by Dr. Schillen as well as my own inspection and technical review of the Perfactory and Vanquish machines in operation to reach an understanding as to the way in which the Perfactory and Vanquish machines process the information received from the CAD model.

9.   Structurally, the Perfactory machine has a cabinet in which the digital light projector, DLP, is housed. A glass plate sits on top of the cabinet and is arranged so that light from the DLP is projected through it. A polymerization tray sits on top of the glass plate and holds a quantity of the curable resin. The bottom surface of the tray is a window which comes into contact with solidified resin during the process of building a part. A build platform is moveably mounted on a vertical shaft affixed to the top of the cabinet. During the build process the part is built upside down, and the build platform moves progressively upward and away from the polymer tray or basement.

3

10.   With the exception of the Perfactory Desktop machine, each of the Perfactory machines includes a motorized basement tilting mechanism. Before the DLP applies light to the underside of the uncured resin, the tilting mechanism tilts the basement to release the recently cured resin from the basement window, and also allows resin to flow and eliminate any trapped bubbles. The build platform is then moved upward allowing fresh resin in the tray or basement to flow beneath the previously solidified voxels. The tilting mechanism is then moved back to its original position before the DLP applies light to the uncured resin again. The process is then repeated. A fill control system monitors the level of uncured resin in the polymerization basement and pumps fresh resin into the basement if the resin drops below a predetermined level.

11.   While I have personally reviewed the operation of the Perfactory machines, I also rely upon the video of the operation of the Perfactory machine to support my description of its operation.

12.   With respect to the Vanquish machines, each one includes a frame that houses a resin tank, a build platform, a digital light projector (DLP), and a pre-processing computer. The build platform of the Vanquish devices is mounted on a vertical support and moves <u>continuously</u> downward during the build process without stopping. Periodically, each mirror of the DLP projects light at the surface of the resin causing it to cure at the defined voxel location based on the particular DLP mirror to which it corresponds. As the Vanquish build platform moves downward, the previously cured resin also moves downward allowing uncured resin to flow over it. A cooling blade moves across the upper surface of the resin because of the large amount of heat that is generated. In addition to my own technical review of the Vanquish machine, I have relied upon the animation prepared by Mr. Shkolnik as being illustrative of the "continuous build" process that is used in the Vanquish machines.

4

B.   <u>Claim 11 of U.S. Patent No. 5,630,981</u>

13.   In my opinion, the Perfactory and Vanquish machines do not infringe claim 11 of the '981 patent for at least the following reasons.

14.   Claim 11 requires "providing data representing the three-dimensional object to be formed which was generated on CAD system". It is my understanding that the Court has interpreted this to mean "providing data representing adjacent cross sectional layers of the three dimensional object to be formed which was generated on a CAD system". As set forth previously in my Declaration, the Perfactory and Vanquish devices use a build volume and voxelization process. They do not provide data representing adjacent cross sectional layers of an object. Instead, with the voxelization process, light intensity is varied on a voxel-by-voxel basis wherein the light intensity for one voxel is independent of any other voxel. Providing data representing adjacent cross sectional layers of the three dimensional object to be formed refers to curing cross-sections of an object from a slice file. This, in turn, requires that the resin be cured with a peak irradiance that does not vary across the surface of the resin. In contrast, the Perfactory and Vanquish machines use a build volume and voxelization process where the light intensity is varied on a voxel-by-voxel basis thereby providing a unique curing depth for each location across the surface of the resin.

15.   Claim 11 also requires forming a first cross-sectional layer and forming successive layers adjacent to the previously formed cross-sectional layers whereby a plurality of cross-sectional layers form the three-dimensional object. The Perfactory and Vanquish machines do not form cross-sectional layers. Instead, as set forth previously, a digital light projector (DLP) projects a uniquely assigned intensity to each location across the resin. The unique and independent intensities result in unique cure depths for avoiding the formation of cross-sectional

5

layers. Further, in the Vanquish machine, the build platform moves continuously downward during the build process rather than in discrete steps. In addition, it is my understanding that the use of the volume build approach for both the Perfactory and Vanquish machines is different from the claimed forming successive cross-sectional layers adjacent to previously formed cross-sectional layers.

16.   The Perfactory and Vanquish devices also do not draw upon a two-dimensional surface. The use of a DLP in the Perfactory and Vanquish machines is substantially different, in my opinion, from a process that applies light by drawing upon a two-dimensional surface.

17.   Claim 11 also requires exposing the photopolymer to light in response to "said data". The Perfactory and Vanquish machines do not expose a photopolymer in response to adjacent cross-sectional layer data from a slice file, since they do not use a slice file.

C.   Claim 81 of U.S. Patent No. 5,902,537

18.   In my opinion, the Perfactory and Vanquish machines do not infringe claim 81 of the '537 patent for at least the following reasons.

19.   Claim 81 requires the forming of a three-dimensional object "on a substantially cross-sectional basis". For the reasons that I have previously stated, the Perfactory and Vanquish machines do not form cross-sectional layers.

20.   Claim 81 also requires "means for supplying data descriptive of the object". It is my understanding that the Court interpreted this to mean a "computer or equivalent that supplies data that is descriptive or representative of adjacent cross-sectional layers of the object". As set forth previously, the Perfactory and Vanquish machines use a build volume and voxelization process and they do not provide data representing adjacent cross-sectional layers of an object.

21.   Claim 81 requires "an applicator". The Perfactory machines clearly do not include an applicator. Further, the cooling element used in the Vanquish machines is not an applicator in my opinion.

22.   Claim 81 requires the forming of cross-sectional layers "over" previously formed cross-sectional layers. For reasons previously stated, the Vanquish and Perfactory machines do not form cross-sectional layers of material. The build platform for the Vanquish machines moves continuously downwardly and does not form layers. The Perfactory machines also do not form layers of material "over" previously formed cross-sectional layers. Instead, fresh resin flows beneath previously solidified resin.

23.   Claim 81 additionally requires a vacuum pump for drawing resin into the applicator. The Perfactory machines do not include a vacuum pump or an applicator nor do they draw resin into an applicator. Further, in my opinion, the Vanquish machines do not include a vacuum pump or an applicator. Instead, they include a movable cooling element, and gravity feed.

24.   Claim 81 requires "means for sweeping the applicator across at least a portion of at least some of the previously formed object cross-sections". It is my understanding that the Court has interpreted this limitation to require a motor-driven threaded shaft for sweeping the applicator across at least a portion of at least some of the previously formed object cross-sections. The Perfactory machines clearly do not include a resin applicator. Further, the Vanquish machines have a cooling element with a dual belt drive that differs substantially from a motor-driven threaded drive shaft. The flexibility of the belts allows them to absorb vibrational energy whereas a motor-driven threaded shaft transmits motor vibration to the resin or build platform. In my opinion, a motor-driven threaded shaft is not equivalent to a dual belt drive

system as used in the Vanquish machines. I recall that at one time 3D Systems intentionally used a motor-driven threaded drive shaft to transmit motor vibration to the applicator.

25.   Claim 81 requires exposing the layers "according to the descriptive data" to form a plurality of object cross-sections. As set forth previously, neither the Perfactory nor Vanquish machines form a plurality of object cross-sections nor do they expose the layers in response to adjacent cross-sectional layer data.

D.   Claim 35 of U.S. Patent No. 4,999,143

26.   In my opinion, the Perfactory and Vanquish machines do not infringe claim 35 of the '143 patent for at least the following reasons.

27.   Claim 35 requires the term "object representation". It is my understanding that the Court has interpreted this to mean "data representing adjacent cross-sectional layers of the three-dimensional object". For the reasons previously stated, neither the Perfactory nor Vanquish machines include an apparatus that uses data representing adjacent cross-sectional layers of the three-dimensional object.

28.   Claim 35 also requires supports which "in cross-sectional width being thin, and comprising a solid which extends along a path connecting said first and second surfaces, the path having a vertical path component which is greater than any horizontal path component". Neither the Perfactory nor the Vanquish machines include a computer programmed to form a support representation wherein the supports comprise a solid extending between a first object surface and a second surface. The Perfactory and Vanquish supports have a plurality of openings through them. The supports also narrow into "teeth" at the point of contact with the object. The Perfactory and Vanquish supports differ from solid supports. Solid supports consume more resin and prolong the length of the build process. The openings in the Perfactory and Vanquish

supports allow uncured resin to flow through the supports during the build process which reduces the force and stress on the supports. Further, the "teeth" in the supports reduce the contact surface area making the object easier to remove from the support as compared to solid supports.

29.   Claim 35 also requires "means for receiving said support representation, and for forming said three-dimensional object out of said medium substantially layer-by-layer, and also for forming said support out of said material substantially layer-by-layer, in accordance with said object and support representations". It is my understanding that the Court interpreted this limitation to require a computer that includes "the CAD generator" and which performs the function of "receiving the support representation". The Court also interpreted this limitation to require "a beam of UV light or an electric beam or a spray and mask or impinging radiation other than light". In addition, the Court construed the term "object...representations" to mean "data representing adjacent cross-sectional layers of the three-dimensional object to be formed which was generated on a CAD system". Neither the Perfactory nor the Vanquish machines include a CAD generator or any computer that generates a CAD model. Neither the Perfactory nor the Vanquish machines use any beam of UV light, an electric beam, a spray and mask, or impinging radiation other than light. Neither the Perfactory nor Vanquish machines include a computer that provides data representing adjacent cross-sectional layers of the three-dimensional object.

E.   Claim 2 of U.S. Patent No. 5,651,934

30.   In my opinion, the Perfactory and Vanquish machines do not infringe claim 2 of the '934 patent for at least the following reasons.

31.   Claim 2 requires a method for "stereolithographically forming a portion of a three-dimensional object". Neither the Perfactory nor Vanquish machines "stereolithographically" form a portion of a three-dimensional object because they do not draw

on a two-dimensional surface. The '934 patent incorporates by reference the '330 patent at 2:20-3:39. The '330 patent states that "It will be apparent from the foregoing that, while a variety of stereolithographic systems have been disclosed for the practice of the present invention, they all have in common the concept of drawing upon a substantially two-dimensional surface and extracting a three-dimensional object from that surface." (The '330 patent at 11:44-60). As set forth previously in my Declaration, the use of a DLP to cure a resin is substantially different from applying light by drawing upon a two-dimensional surface.

32.   Claim 2 also requires that "a subsequent layer of the three-dimensional object is formed over a previously formed layer of the object". The Perfactory and Vanquish machines do not form layers of a three-dimensional object. As set forth previously, the Vanquish machines include a build platform that moves continuously downward during the build process which avoids the production of layers. The Perfactory machines do not form layers and do not form a subsequent layer of an object "over" a previous layer of the object. Instead, they build parts upside down, on a voxel-by-voxel basis.

33.   Claim 2 requires "forming a uniform coating of desired layer thickness over the previously formed layer". I understand that the Court construed "uniform" to mean "smooth, level". The Perfactory and Vanquish machines do not form a uniform coating of desired layer thickness. The Vanquish machines include a build platform that moves continuously downward into a resin-filled tank during the build process. The DLP projects light to cure the resin while the build platform continues to move downward. The use of a continuous build process avoids the formation of layers and produces a working resin surface that is not level. The Perfactory devices also do not form a uniform coating of a desired layer thickness "over" a previously

formed layer. Further, because of the build volume and voxelization process, the DLP projects light to cure the resin in a volumetric way that is fundamentally neither uniform nor level.
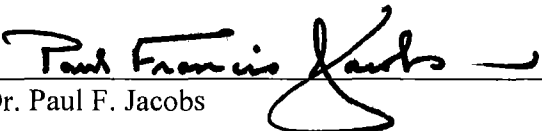
34.   Claim 2 requires sweeping a winged blade over the previously formed layer. The Perfactory machines clearly do not include a winged blade or any analogous structure. The cooling element of the Vanquish machines is not, in my opinion, a winged blade for smoothing resin over the previously formed layer and it does not include "separate members on a lower surface thereof for contacting the building material".

35.   Claim 2 requires applying a prescribed pattern of synergistic stimulation to the building material at the working surface. It is my opinion that the claim's reference to a method for stereolithographically forming a three-dimensional object, means that drawing upon a substantially two-dimensional surface is required. Neither the Perfactory nor Vanquish machines draw upon a two-dimensional surface.

36.   Based upon my study and analysis, as set forth above, it is my opinion that the Envisiontec Perfactory and Vanquish machines do not infringe claim 11 of the '981 patent, claim 81 of the '537 patent, claim 35 of the '143 patent, or claim 2 of the '934 patent either literally or under any argument of equivalents. In my opinion the Perfactory and Vanquish machines operate in a different way to achieve a different result for the reasons previously discussed.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Executed on this, the ___16th___ day of July, 2008.

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Dr. Paul F. Jacobs

<u>CERTIFICATE OF SERVICE</u>

I hereby certify that on August 4, 2008, I electronically filed the foregoing paper with the Clerk of the Court using the ECF system which will send notification of such filing to the following: Jonathan A. David, Susan M. Kornfield and Alan N. Harris, and I hereby certify that I have served the foregoing paper via Federal Express on the following non-ECF participants:

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